

An Evidence Based Approach to Designing Medical Support for Long Duration, Interplanetary Missions

S.D. Watkins, T.L. McGrath², D.K. Baumann², J.H. Wu³, K.N. Barsten⁴, Y.R. Barr¹, and E.L. Kerstman¹

¹The University of Texas Medical Branch, ²NASA Johnson Space Center, ³Wyle Integrated Science and Engineering, ⁴Enterprise Advisory Services, Inc.

ABSTRACT

The Exploration Medical Capability (ExMC) element is one of six elements under NASA's Human Research Program (HRP). The goal of the ExMC element is to address the risk of the "inability to adequately recognize or treat an ill or injured crewmember." This poster highlights the evidence-based approach that the ExMC element has taken to address this goal, and the ExMC element's current areas of interest.



Artist's Concept of Manned Interplanetary Mission, NASA

LINKS

Human Research Program Site
<http://www.nasa.gov/exploration/humanresearch/>

Human Research Roadmap
<http://humanresearchroadmap.nasa.gov/>

Human Research Wiki
<http://humanresearchwiki.jsc.nasa.gov/>

CONTACT

Sharmi Watkins, MD, MPH
ExMC Element Scientist
Sharmila.Watkins@NASA.gov

Tammie McGrath
ExMC Element Manager
Tammie.L.McGrath@NASA.gov

THE HUMAN RESEARCH PROGRAM

NASA's Human Research Program (HRP) conducts research and develops technologies that allow humans to travel safely and productively in the environment of space.

The HRP is comprised of six elements

- International Space Station Medical Project
- Space Radiation
- Human Health Countermeasures
- Exploration Medical Capability
- Behavioral Health & Performance
- Space Human Factors and Habitability

The National Space Biomedical Research Institute (NSBRI) is a partner with the HRP in developing a successful human research program.

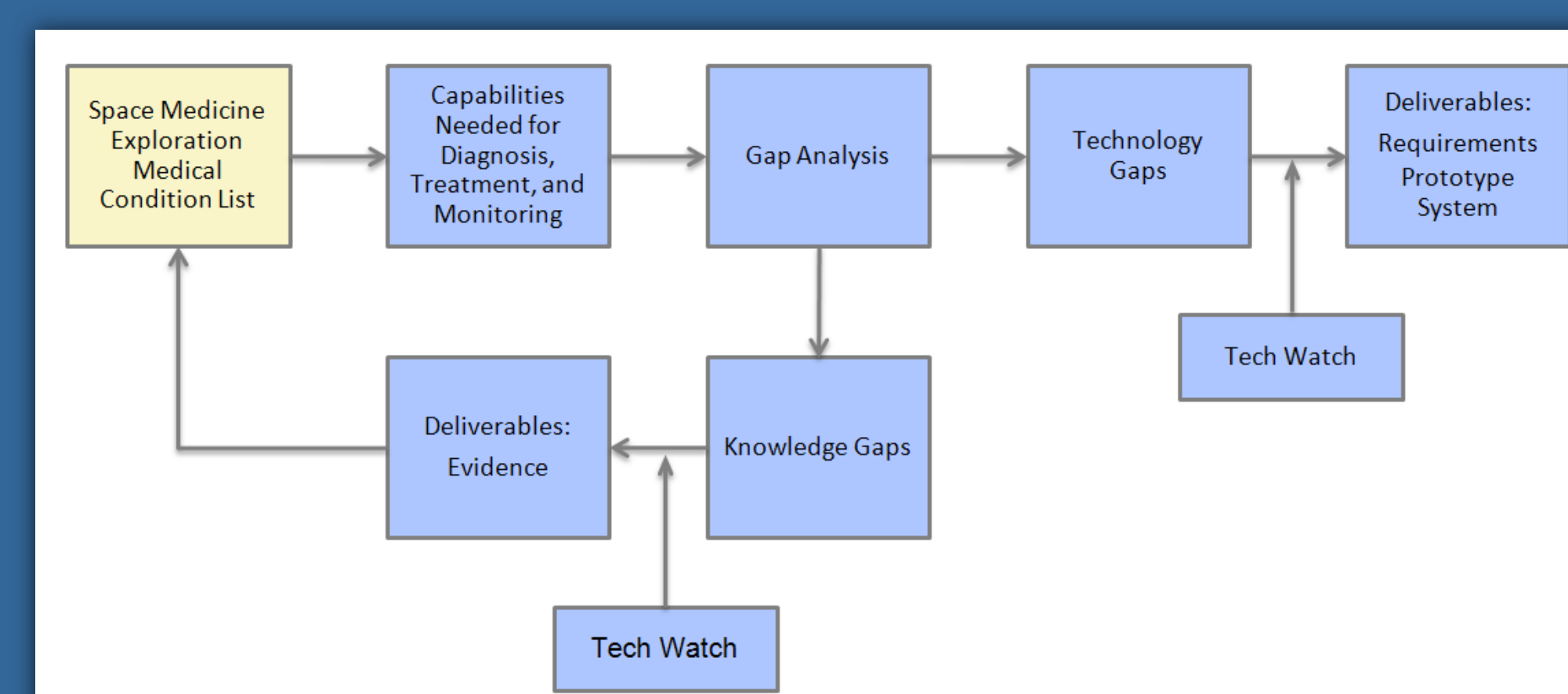
EXPLORATION MEDICAL CAPABILITY

The Exploration Medical Capability (ExMC) element is charged with reducing the risk of the "inability to adequately recognize or treat an ill or injured crewmember" during an exploration mission.

To address this risk, the element must

- Define requirements for crew health maintenance
- Develop treatment scenarios
- Extrapolate from the scenarios to health management modalities
- Evaluate the feasibility of these modalities
- Develop technology and informatics that will enable the availability of medical care and decision systems

APPROACH



THE MEDICAL CONDITION LIST

To address the broad risk of the inability to adequately recognize or treat an ill or injured crewmember, the element identified medical conditions of concern for exploration missions.

The conditions were gathered from several sources

- Spaceflight medical incidents
- Conditions on the Shuttle medical checklist
- Conditions on the International Space Station (ISS) medical checklist
- Expert opinion

There are currently eighty-five conditions on the condition list approved by NASA's Space Medicine Division.

The conditions were prioritized by a panel of flight surgeons, physician astronauts, engineers, and scientists based on incidence, consequence, and mitigation capability.

The condition list is a "living document"

- New conditions can be added to the list
- The priority of conditions on the list can be adjusted as screening, diagnosis, or treatment capabilities change

IDENTIFICATION OF GAPS

From the prioritized condition list, the ExMC element annually determines the capabilities needed to address the medical conditions of concern.

Where such capabilities are not currently available, a gap is identified.

The ExMC element currently identifies gaps in the following areas

- Validation of Medical Standards
- Risk Quantification
- Risk Mitigation
- Monitoring and Treatment of Conditions of Concern
- Enabling Capabilities

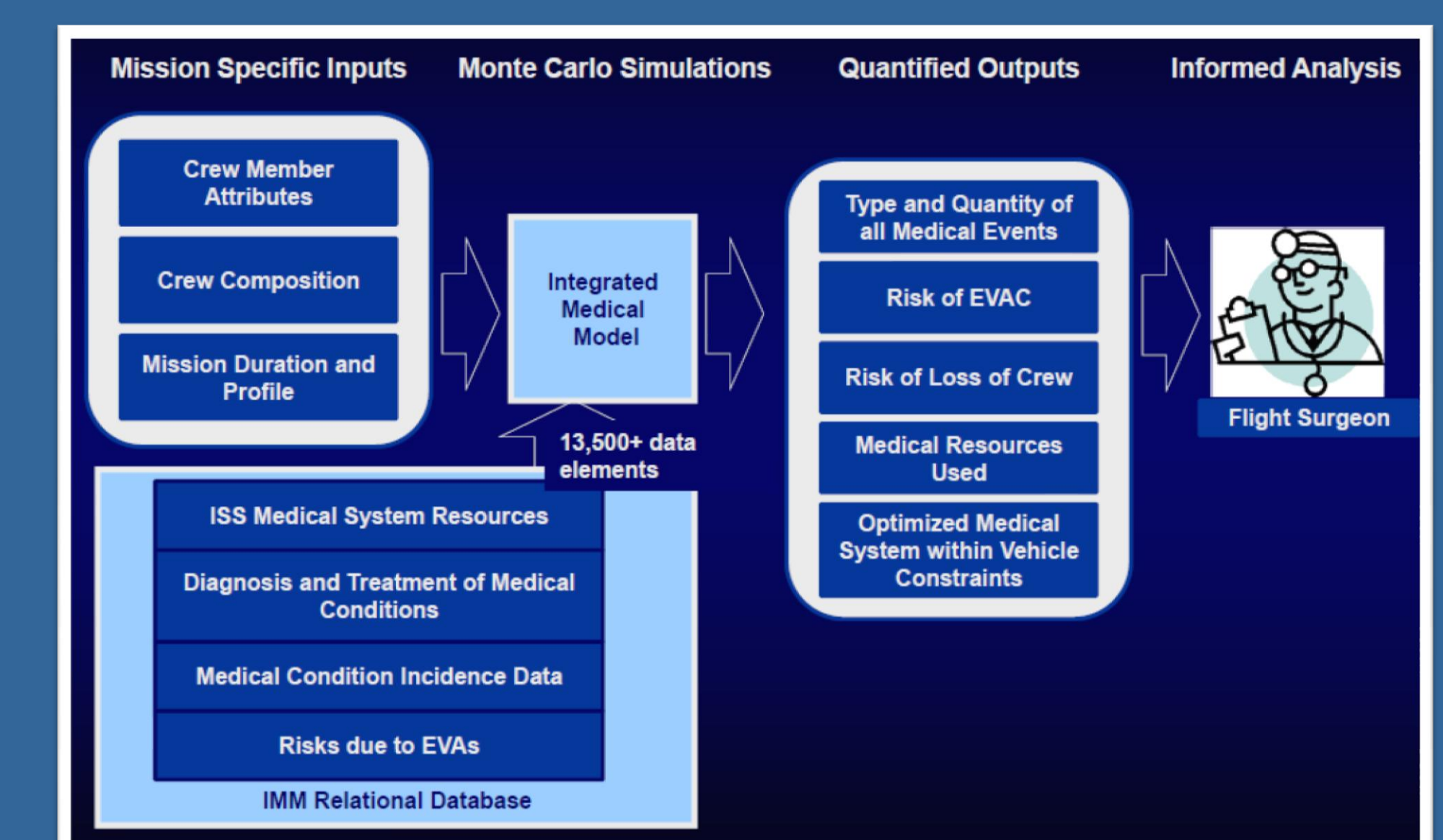
TECHNOLOGY WATCH

For each gap, the ExMC element conducts a technology watch to identify emerging high-impact technologies that

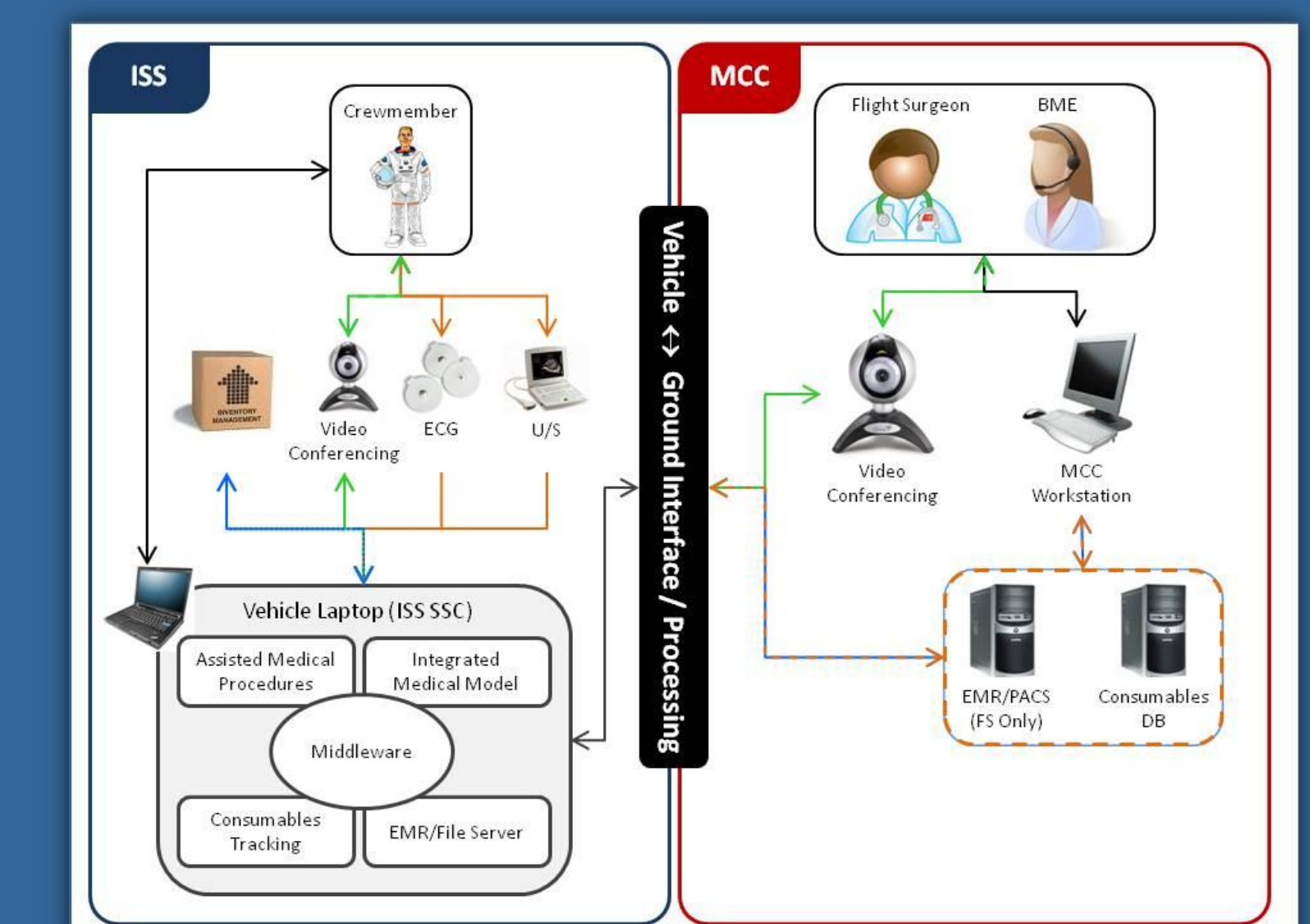
- Augment ongoing efforts
- Accelerate the development of medical care and research capabilities

MAJOR PROJECTS

•The **Integrated Medical Model** is a decision support tool useful to mission planners and medical system designers in assessing risk and designing medical systems for specified space flight missions.



•The **Exploration Medical System Demonstration** is a project tasked with developing an integrated, smart medical platform for an ISS demonstration.



AREAS OF INTEREST

- Novel medical screening technologies
- Delivery of medical training to non-clinicians
- Autonomous medical procedure systems
- Noninvasive diagnostic imaging
- Smart ventilators and oxygen concentrators
- Minimally invasive laboratory capabilities
- Stabilization and treatment of bone fractures
- Wound care and wound closure
- Advanced dental care
- Intravenous fluid generation
- Inventory tracking for medications and other consumables
- Medication stability and shelf-life preservation
- Biomedical monitoring capabilities
- Medical data management systems
- Prevention and treatment of radiation sickness